Sentiment Analysis

A Probabilistic Approach

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Outline

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The goal of the project

Project Description

Performing sentiment analysis on messages about the EO

- Classification Sentiment vs. Non Sentiment
- Classification Positive vs. Negative

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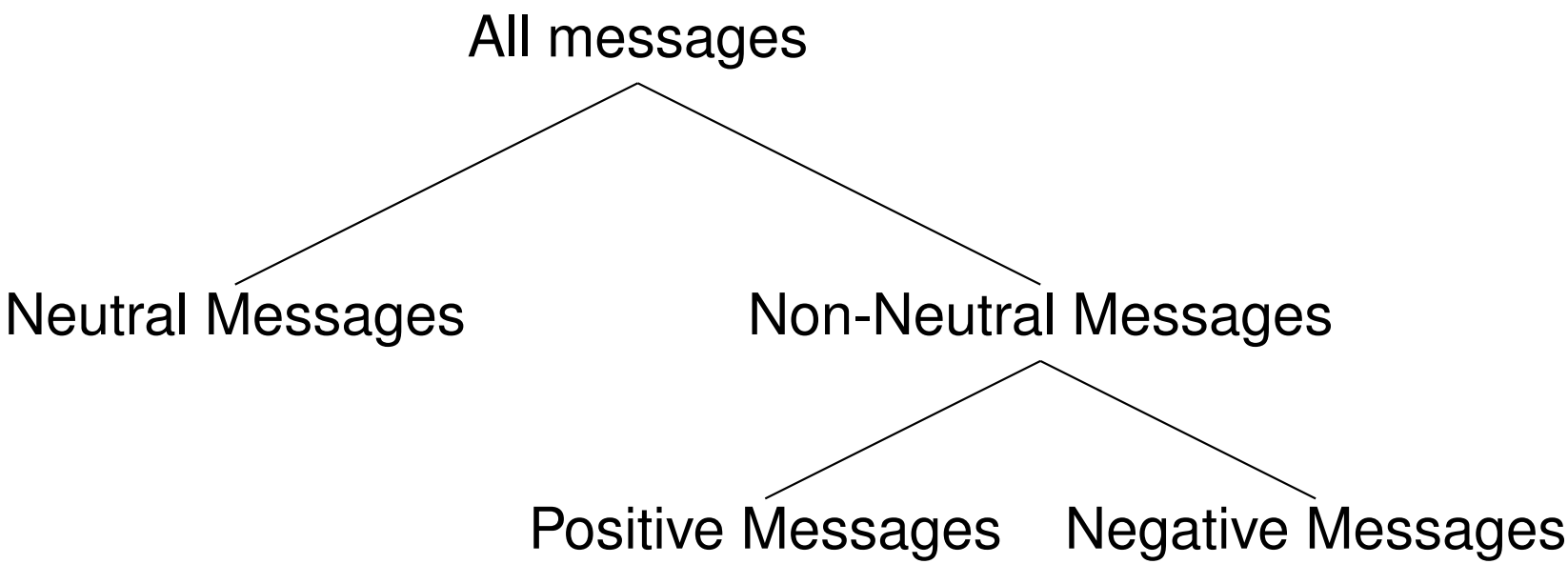
Approach

- Preprocessing of the data
- Perform machine learning algorithms on data
- Use best algorithms to classify real time on server

Hierarchical Classification



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Dataset Analysis

Dataset messages EO

10.000 messages, 19 features per message

Ony 3 features used:

- Source
- Sentiment
- Message contents

Data Cleaning

- Shorten words, e.g. ‘saaaaaaai’ to ‘saaai’
- Stemmer

Data Reduction

- Only use Twitter messages (83% of all messages)
- Remove articles, personal pronouns and prepositions
- Substitute smileys with words
- Remove some punctuation marks (not ! ?)

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Classification

Weighted Sum Probability

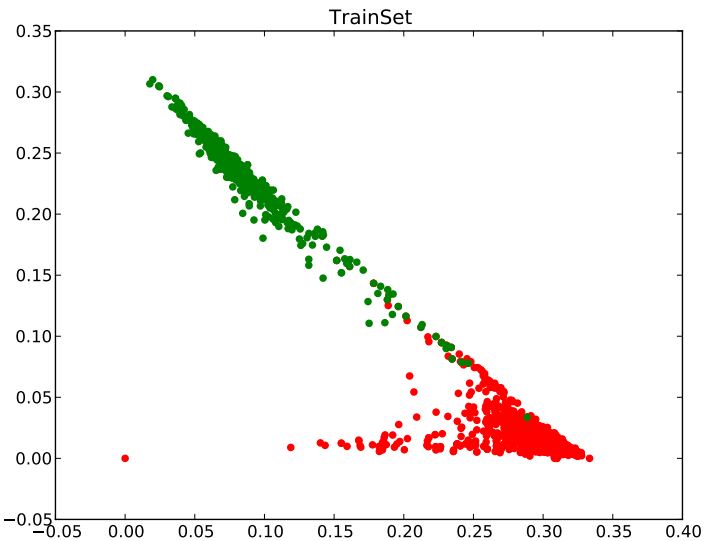
- Extract features
- Assign sentiment probabilities to features

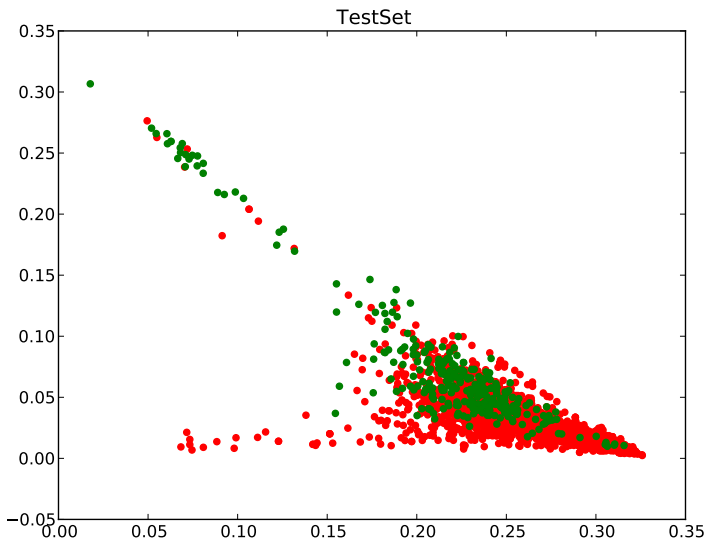
$$P(feature) = \frac{\sum feature \in C_1}{\sum feature \in C_1 \cup C_2} \quad (1)$$

- Assign sentiment probabilities to sentences

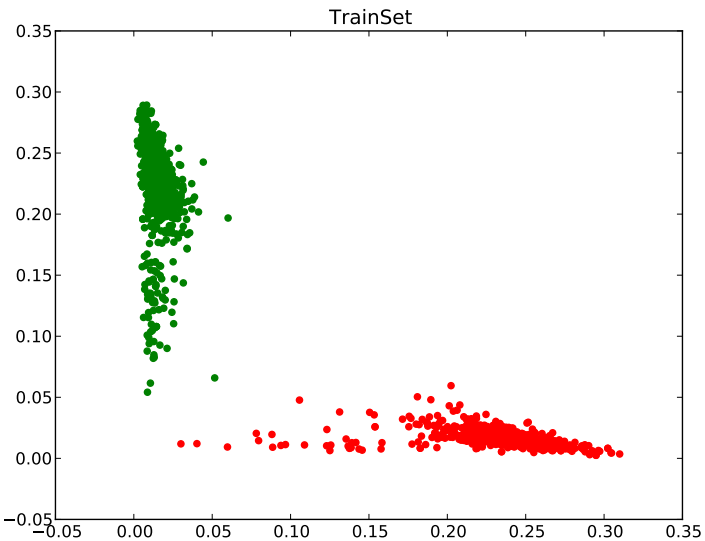
$$P(s) = \frac{1}{n} \sum_{f \in s} P(f) \quad (2)$$

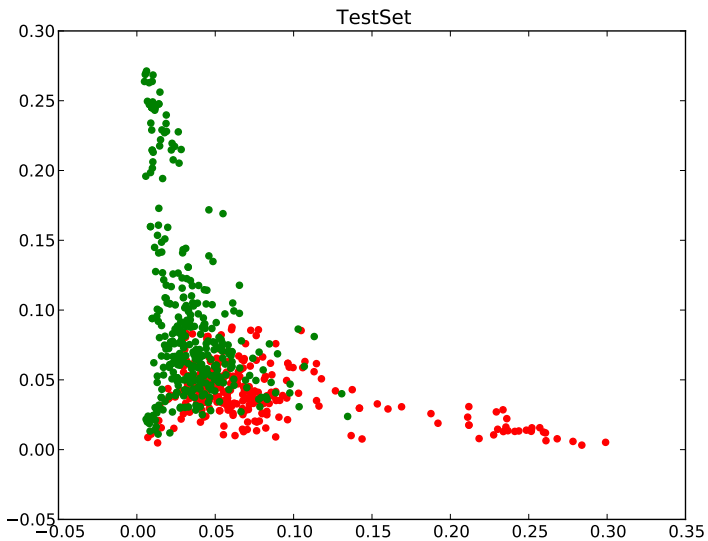
WSP: Neutral vs Non-Neutral





WSP:Positive vs Negative





Perceptron

Algorithm

Train linear treshold

Input : Sentence probabilities, sentence values

Output : Treshold

Results & Conclusion

Results : High precision OR recall, never both

Conclusion : Linear threshold not good enough

Support Vector Machine

Algorithm

Fit in featurespace that binds features to classes

Input : Features in vector

Output : Number belonging to class

Results & Conclusion

Results : Not very good recall/precision/accuracy

Conclusion : Fit can not be made on these features
or more data needed to find clear boundary

Naive Bayes

Algorithm

Prior and likelihood lead to posterior

Input : Features from sentence

Output : Probability

Results & Conclusion

		Recall	Accuracy	Precision
Results :	Positive	0.43	0.81	0.39
	Negative	0.40	0.71	0.17
	Neutral	0.61	0.59	0.79

Conclusion : Low recall and precision

Multiclassification with Perceptron

Algorithm

Specialized perceptron for each class, one vs. all

Input : Sentence probability for class

Output : Most likely class

Results & Conclusion

Results :

Test \Real	True	False
True	41	22
False	113	418

Accuracy = 0.77

Precision = 0.65

Time taken: 33 sec

Conclusion : Moderate results

Entropy

Algorithm

Words with highest likelihood for class

Input : Corpus

Output : Most likely class

Results & Conclusion

		Recall	Accuracy	Precision
Results :	Positive	0.42	0.74	0.25
	Negative	0.22	0.88	0.47
	Neutral	0.76	0.69	0.80

Conclusion : No satisfying results for positive and negative classification

Neural Network

Algorithm

Backpropagation

Input : Features from sentence

Output : Value for outputnodes (classes)

Results & Conclusion

Results : Training time = 2.85 hours for 500 sentences.

Test \Real	True	False
True	14	6
False	40	94

Conclusion : Still many messages with sentiment incorrectly classified.
Possible cause: ratio of messages with sentiment and nonsentiment.

Outline

Webserver Framework

Request → Server (PHP/PYTHON) → Result (XML)

Request http://url.com/?**dataset**=1&**message**=De EO is cool!

Result XML File (Containing: Status, Message, Sentiment, Accuracy, Precision, Recall)

Demo

Action...

Outline

Conclusion

- All learning algorithms have their (dis)advantages
- Multiclassification with perceptron and Neural Networks give best results
- Not enough data

Questions?